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Evolving treatments for pediatric epilepsy

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Abstract

Traditional surgical procedures, such as localization and resection of epileptogenic foci and disconnection techniques, are currently used to treat drug-resistant focal epilepsy (DRFE) in children. Pediatric epilepsy surgery rates have increased from 0.85 surgeries per 1000 children with epilepsy in 1997 to 1.44 surgeries per 1000 children with epilepsy in 2009. In a prospective study of DRFE, 86% of children and 43% of adults were off antiepileptic drugs (AEDs) 10 years after surgery as compared with 0/93 nonsurgical controls. Reducing the life-long morbidity of childhood epilepsy can improve the quality of life of the children and their families and reduce healthcare costs. Many patients are not candidates for resection procedures when the seizure onset or network involves multiple cortical regions or eloquent cortex. Responsive neurostimulation (RNS System) therapy has been safely and successfully used in the adult population for the treatment of DRFE with one or two seizure foci.

The recent available data suggests similar outcomes in the treatment of pediatric patients with DRFE as well as multi-focal epilepsy using responsive neurostimulation. Our outcomes in the pediatric population demonstrate safety, decreased clinical seizure frequency, as well as improved functional status and quality of life. The increase in efficacy over time observed with responsive stimulation is similar to other neurostimulation approaches, including VNS and open-loop DBS of the anterior thalamic nucleus.

The exact mechanism of action of neurostimulation is unknown, with immediate effects that may be mediated by local cellular inhibition and/or excitation, related to changes in cerebral blood flow, or to the release of neurotransmitters from axons and bordering astrocytes.

The sustained therapeutic effects could be explained by alterations in neuronal networks, involving synaptic plasticity, neurogenesis, and cortical reorganization, with possible enhanced effects in a young, developing brain.

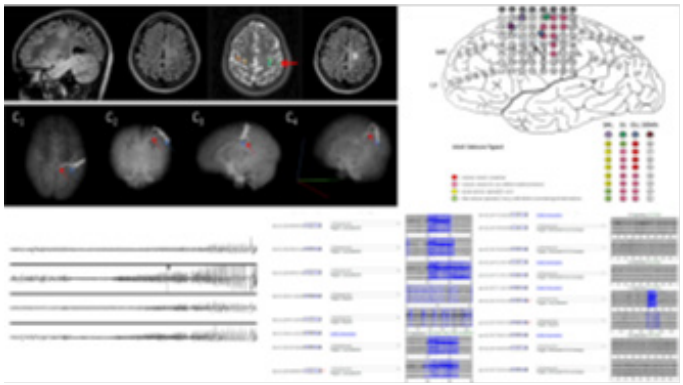

Image 1: Responsive neurostimulation for eloquent cortex epilepsy

Biography

M. Michael Bercu, MD, MSc is a pediatric and functional neurosurgeon with expertise in complex and advanced neurosurgical procedures, with an emphasis on novel minimally invasive techniques, including directional brain neuromodulation, laser ablations and responsive neurostimulation for intractable epilepsy disorders. Additional areas of interest include minimally invasive approaches for brain tumors and malformations (MIPS), as well as the development and implementation of new technologies such as focused ultrasound. His experience in the field of stem cells research grants him additional tools to contribute to the development of novel treatments for pediatric and adult patients suffering from traumatic brain and spine injuries as well as neurodegenerative disorders.

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